

## Alternatives

This chapter includes information on the process by which transportation alternatives were identified and evaluated in the MIS, and a rationale that supports the selection of alternatives included in this Draft EIS. The chapter also provides a description of each of the Draft EIS alternatives, including costs and operations.

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### 2.1 Alternatives Selection Process

Alternatives considered in this Draft EIS as potential solutions to meet the project purpose and need were developed during the MIS process, which identified a wide range of potential actions and, through an iterative screening process, identified a narrower range of alternatives for further detailed study. The *Route 2/2A/32 Major Investment Study Final Report* (January, 1997) provides additional detail on the screening process, the preliminary alternatives considered, and the rationale for eliminating certain strategies from further study.

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#### 2.1.1 Alternatives Considered in the MIS

The MAC, working with ConnDOT, identified more than 100 strategies that were thought to provide some level of transportation benefit. These strategies included improvements to existing roads, new roads, traffic management, transit, rail, multimodal, traffic volume reduction, and changes in land use and zoning. Some of the specific strategies were construction of regional loop systems for rail, monorail, or bus; traffic calming; reversible lanes on major roadways; and improved routing of existing bus services. A preliminary screening process eliminated those strategies that were outside of the study area limits, clearly did not address traffic problems, or that required further study outside the scope of the MIS.

The remaining strategies were evaluated in a “First Level Screening” which took into account potential environmental impacts, costs and transportation effects. This analysis was performed at a qualitative level, using available geographic information systems (GIS) and traffic data. Strategies in this screening included:

- Route 2: no action, upgrades, widening, traffic management, southern bypass; northern bypass
- Route 2A: no action, upgrades, widening, northern bypass, southern bypass
- Rail and transit along the NECR line, the P&W line, and new alignments
- Route 32: upgrades and widening
- Other Roads: improvements to Route 214, Shewville Road, and Route 164

Nine packages of strategies were developed from these elements and evaluated in a more detailed “Second Level Screening”. This evaluation process was based on assessment of whether each package was likely to provide a significant positive effect on safety or travel demands; an acceptable level of environmental impact; and whether it was likely to be cost effective. The 9 packages evaluated included:

1. No Action
2. Widen Route 2 to 4 lanes between Route 214 and I-95; southern bypass of Route 2A; upgrade Routes 164 and 32
3. Widen Route 2 to 4 lanes between Route 2A and I-95; northern bypass of Route 2A; upgrade Routes 164 and 32
4. Southern bypass of Route 2; southern bypass of Route 2A; widen Route 2 to 4 lanes between Route 214 and the Route 2 Bypass; upgrade Routes 164 and 32
5. Southern bypass of Route 2; northern bypass of Route 2A; widen Route 2 to 4 lanes between the bypasses; upgrade Routes 164 and 32
6. Light rail or monorail system between Westerly and Norwich; widen Route 32 to 4 lanes; upgrade Route 2 between Route 214 and I-95; upgrade Route 164
7. Dedicated busway between Westerly and Norwich; widen Route 32 to 4 lanes; upgrade Route 2 between Route 214 and I-95; upgrade Route 164
8. Light rail or monorail between Westerly and Norwich; passenger rail service between New London and Norwich on the NECR line; upgrade Route 2 between Route 214 and I-95; upgrade Routes 164 and 32
9. Light rail or monorail between Westerly and Norwich; passenger rail service between New London and Norwich on the NECR line; new rail bridge over the Thames River to provide direct service connections; upgrade Route 2 between Route 214 and I-95; upgrade Routes 164 and 32

This screening process determined that several elements and packages should not be studied in more detail in the EIS. Widening Route 32 to 4 lanes was not warranted by traffic projections. A southern bypass of Route 2A would have substantially more environmental impact than a northern bypass, while providing similar transportation benefits. For these reasons, packages 2, 4, and 6 were eliminated from further consideration. Package 7 was retained, but without the Route 32 widening element.

The MIS recommended that a balanced range of roadway and transit options be considered in the EIS, and recognized that all alternatives have varying degrees of environmental and social impact. The MIS also concluded that transit alternatives have the potential to remove a significant amount of traffic from local roads if parking at the casinos was limited, but would not fully address transportation needs in the region.

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### **2.1.2 Alternatives Considered in the Draft EIS**

At the conclusion of the MIS process, a Scoping Meeting was held to determine the scope of the EIS. Six alternatives, each consisting of several transportation elements, were recommended for evaluation in the DEIS. The principal elements of each alternative were:

- A. No Action
- B. Rail/Transit, including passenger rail between New London and Norwich on the NECR and light rail/monorail between Westerly and Norwich, with a shuttle bus service connection
- C. Rail/Transit, including passenger rail between New London and Norwich on the NECR and light rail/monorail between Westerly and Norwich, with direct connection between the two systems via a new rail bridge across the Thames River
- D. Bus service between Westerly and Norwich utilizing a dedicated busway between Westerly and Foxwoods
- E. Bypass of Route 2A on a northern alignment, with widening Route 2 and the expansion of the Mohegan-Pequot Bridge to 4 lanes
- F. Bypass of Route 2A on a northern alignment, with widening the Mohegan-Pequot Bridge to 4 lanes; bypass of Route 2 on a southern alignment; widening Route 2 between the two bypasses to 4 lanes

In addition, the rail, transit and bus alternatives (B, C, D) would include upgrades to Route 2, and the roadway alternatives (E, F) would include upgrades to Routes 32 and 164. Table 2.1-1 illustrates the relationship of project elements to the 5 Build alternatives.

**Table 2.1-1**  
**Alternatives Considered in the Draft EIS**

Element	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
Transitway	●	●			
Busway			●		
NECR	●	●			
NECR Stations	●	●			
Transit Stations	●	●	●		
Transit Bridge		●			
Route 2 Upgrade, Norwich			●		
Route 2 Upgrade, North Stonington	●	●	●		
Route 2 Widening, Preston				●	●
Route 2 Widening, North Stonington				●	
Route 32 Upgrade				●	●
Route 164 Upgrade				●	●
Route 2A Bypass				●	●
Widen Route 2A Bridge				●	●
Route 2 Bypass					●

## 2.2 Draft EIS Alternatives

This Draft EIS provides an assessment and evaluation of 6 transportation alternatives ([Figure 2.2-1](#)). This section provides a description of each of the alternatives. Additional detailed information on design, operations, and costs is provided in the *Engineering and Transportation Technical Reports*, the *Financial Evaluation*, the *Station Site Selection Report*, and in the *Conceptual Design Standards for Transit*. These reports are available for review at Town Halls and public libraries in the study area, and at ConnDOT.

### 2.2.1 Alternative A (No-Action)

Alternative A, No-Action, assumes that no new construction would be undertaken by ConnDOT. This alternative does assume that roadway improvement projects which have been approved, but not constructed, would be completed.

Alternative A would not include any new construction within the Route 2, 2A, or 32 corridors by ConnDOT other than improvements that have already been approved and are scheduled for construction. The No-Action Alternative therefore includes the following actions programmed or planned to be constructed by ConnDOT or other entities:

- Widening Route 2 to 4 lanes between I-95 and Route 78 in Stonington
- Widening Route 2 to 4 lanes between Route 164 and Route 214 in Preston and Ledyard
- Construction of the Norwich Transportation Center
- Widening and improvements to Route 32 south of the I-395 Connector in Waterford

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## **2.2.2 Alternative B (Rail/Transit)**

Alternative B includes passenger rail service between New London and Norwich along the NECR line with stops at 6 stations; light rail or monorail service along a dedicated transitway between Westerly and Norwich, with stops at 7 stations; and a shuttle bus service to provide connections between the two transit systems. Route 2, between Route 214 and I-95, would be upgraded to provide safety improvements.

### **2.2.2.1 Description**

Alternative B ([Figure 2.2-2](#)) includes five elements: passenger rail, passenger rail stations, transitway, transit stations, and the Route 2 upgrade. This section describes the physical and operational characteristics of each element. Table 2.2-1 summarizes the length and number of stations for Alternative B, and the subsequent alternatives.

#### **Passenger Rail**

Alternative B would provide passenger rail service along the existing, single-track, NECR from the New London Amtrak station to the I-395 Transportation Center. No major reconstruction of the existing rail bed, track, bridges, or grade crossings are anticipated in order to add passenger service to the line, which is currently used for freight service. However, maintenance and upgrading of the ballast, ties, track, and grade crossing surfaces is anticipated to maintain the line's current Federal Railroad Administration (FRA) Class 3 rating. Rails and ties would be replaced, and ballast would be cleaned and replaced as required. All grade crossing surfaces would be rebuilt, and crossing protection upgraded at all protected crossings. All undergrade bridges (where the rail is on a bridge) would be rehabilitated. Two passing sidings would also be required: one north of Trading Cove, extending to the existing double-tracked section of the NECR in Norwich, and a short passing siding at the Connecticut College station

(Figure 2.2-3). The Norwich siding would require adding one additional track for a distance of 200 m (656 ft), on the landward side of the existing track. A 135-m (443-ft) retaining wall would be constructed at the limit of the right-of-way to reduce impacts. The Connecticut College siding would be 65 m (213 ft) long. Both sidings would involve construction only within the existing right-of-way, and would widen the existing disturbed area by approximately 4.3 m (14 ft).

**Table 2.2-1  
Summary of Alternatives**

Alternative	Rail/Transit Stations (new/ existing)	Heavy Rail Upgrade	New Transit/ Monorail	New Roadway (or busway)	Widened Road	Upgraded Road	Total Length
A	0	0	0	0	0	0	0
B	10/3	10 km (6.2 mi)	36.8 km (23 mi)	0	0	11.4 km (7.1 mi)	58.2 km (36.4 mi)
C	11/3	10 km (6.2 m)l	37.6 km (23.5 mi)	0	0	11.4 km (7.1 mi)	59 km (36.9 mk)
D	3/3	0	0	20.1 km (12.6 mi)	0	13.4 km (8.4 mi)	33.5 km (20.9 mi)
E	0	0	0	3.5 km (2.2 mi)	16.9 km (10.6 mi)	12.3 km (7.7 mi)	32.7 km (20.4 mi)
F	0	0	0	14.2 km (8.9 mk)	5.5 km (3.4 mi)	12.3 km (7.7 mi)	32.0 km (20 mi)

### Passenger Rail Stations

**New London Station** – The rail service would use the existing Amtrak rail station, and would not require any new construction.

**Connecticut College Station** – This station would serve Connecticut College and the U.S. Coast Guard Academy. The station would be located at the end of Farnsworth Street, and would require construction of a platform and shuttle bus turn-around ([Figure 2.2-4](#)).

**Waterford Station** – This station would be located at the end of Scotch Cap Road, adjacent to the Thames Landing development. The developer is committed to the construction of a public parking lot with access to a waterfront park and marina. The station would require the construction of a platform, and would use the public parking lot provided by the development ([Figure 2.2-5](#))

**Mohegan Sun Station** – This station would be located at the Mohegan Sun casino, south of Trading Cove. This station would require only the construction of a platform adjacent to the existing parking lot. If Alternative C, South Bridge option were selected, a transfer station between the light rail/monorail system and the commuter rail system would also be constructed immediately north of the Mohegan-Pequot Bridge ([Figure 2.2-6](#)).

**Norwich West Transportation Center** – a Transportation Center would be constructed on Thames Street in Norwich, immediately north of Route 82 (West

Main Street). The site is currently developed and used as a school bus parking area (Figure 2.2-7).

**I-395 Transportation Center** – A transportation center would be constructed in Yantic on West Town Street, approximately 1.1 km (0.7 mi) west of I-395. The proposed transportation center site is currently developed, and would require the relocation of several existing businesses, construction of a platform and parking structure (Figure 2.2-8).

## Transitway

The Transitway would be designed to provide either light rail or monorail service. The right-of-way width anticipated for the transitway would be 15.5 m (51 ft), sufficient to provide two tracks for optimal service (Figure 2.2-9). Light rail would be electrified through an overhead catenary system. Intersections with major roads would be grade-separated. Monorail would be elevated on piers, but would require an at-grade service road (Figure 2.2-10). A storage and maintenance facility would also be required. The planning concept assumes that this facility would be located in the existing P&W RR yards in Norwich.

The transitway concept is 36.8 km (23.0 mi) in length, and extends from the Norwich (East) Transportation Center at the intersection of Routes 2 and 12 to the Westerly (RI) Amtrak station. Figure 2.2-10 illustrates the planning concept for the transitway. From Norwich, the transitway would use the existing P&W right-of-way for 4.6 km (2.9 mi) to the Norwich State Hospital property. A new bridge would be constructed at the Shetucket River in Norwich, and a new tunnel would be constructed under Route 12. From the State Hospital Transportation Center, the transitway would cross under Route 12 and over Route 2A. The transitway would extend on new alignment north of Route 2A, crossing Harris Fuller, Middle, and Schoolhouse Roads. The alignment would cross Routes 2A and 117 just north of their intersection in Poquetanuck Village, and would include a station on Lincoln Park Drive.

From Poquetanuck, the transitway would generally follow a former trolley alignment eastward, south of Route 2, crossing Matthewson Mill Road and Shewville Road. The alignment would cross to the north of Route 2 approximately 650 m (2,100 ft) east of Watson Hill Road, continue along the north side of Route 2, and cross to the south of Route 2 at the intersection with Route 214. From this point, the transitway alignment would generally follow the former trolley line to the intersection of Routes 2 and 201, where it would cross back to the north side of Route 2.

The transitway alignment would continue north of North Stonington village, crossing Wyassup Road approximately 400 m (1,300 ft) north of Babcock Road. The alignment would be located east of Route 2, crossing Route 184 approximately 300 m (1,000 ft) east of the rotary. From Route 184, the transitway would cross over I-95 and Route 49. South of the transportation center, the transitway would continue south along the west side of the Pawcatuck River,

and would be bridged across the Pawcatuck River north of Route 78. The alignment would cross White Rock Road in Westerly approximately 50 m (160 ft) north of Route 78. The transitway would follow Route 78 to the Amtrak right-of-way, and would be constructed parallel to the Amtrak tracks for 1.8 km (1.2 mi) to the Westerly Station.

Connections between the transitway and the passenger rail system on the west side of the Thames River would be made by a shuttle bus service operating between the Norwich State Hospital Transportation Center and the Mohegan Sun Transportation Center, across the existing Route 2A (Mohegan-Pequot) Bridge.

### **Transit Stations**

**Norwich East Transportation Center** – The transitway would terminate at the Norwich Transportation Center in downtown Norwich, at the intersection of Routes 2 and 12. The Transportation Center is being proposed and would be developed by the City of Norwich. An additional track and platform would be required to accommodate light rail or monorail vehicles.

**Norwich State Hospital Transportation Center** – A transportation center would be constructed at the former Norwich State Hospital site, immediately west of Route 12 and north of the Mohegan-Pequot Bridge. The center would require the construction of a platform and parking structure to accommodate a substantial number of vehicles (Figure 2.2-12).

**Poquetanuck Station** – A village station would be constructed in Poquetanuck Village, on Lincoln Park Drive just east of Route 2A. The station would consist of a platform and small parking lot, and would provide pedestrian access to Poquetanuck, Hallville, and the Lincoln Park residences (Figure 2.2-13).

**Foxwoods Station** – A station along the transitway at the Foxwoods Casino would serve casino patrons and employees. The station would consist of a platform and a pedestrian bridge over Route 2 (Figure 2.2-14). A “people-mover” or other form of conveyance would be considered as an option to improve pedestrian access to the casino.

**North Stonington Station** – This station would provide a village station north of Route 2 opposite the Holly Green shopping center. This station would require the construction of a platform and small parking lot, and would provide pedestrian access to the Holly Green area (Figure 2.2-15).

**I-95 Transportation Center** – A major transportation center would be constructed just south of Exit 92 of I-95, east of Route 49. The station would require the construction of a platform and parking for an estimated 2500 vehicles (Figure 2.2-16).

**Westerly Station** – The transitway would use the existing Westerly Amtrak station, and would require construction of a new platform and extension of the existing pedestrian underpass.

## **Route 2 Upgrade**

Route 2 in North Stonington, from Route 214 to I-95, would be upgraded to provide a uniform roadway cross-section of 12.2 m (40 ft), with two 3.7-m (12-ft) travel lanes and two 2.4-m (8-ft) paved shoulders (Figure 2.2-17). The upgrade would extend approximately 11.4 km (7.3 mi). Figure 2.2-18 illustrates the planning concept for this element.

### **2.2.2.2 Estimated Cost**

Costs for Alternative B have been estimated separately for the light rail and monorail modes. As shown on Table 2.2-2, the light rail mode would have an estimated capital cost of \$599 million, with an annual operating cost of \$16.8 million. Capital costs include a construction cost of \$564.3 million for the light rail/heavy rail mode, and \$3.49 billion for the monorail/heavy rail combination. Capital equipment costs are estimated at \$34.3 million for light rail, and \$41.3 million for monorail. The net annualized cost would be approximately \$57.2 million, with a cost effectiveness (cost per new transit rider, taking into consideration total annual infrastructure, operating and capital costs) of \$13.04 and a subsidy of \$1.81 per passenger. Acquisition of new right-of-way is anticipated to cost an additional \$1 million.

The monorail mode would be substantially more expensive, with a capital cost of \$3.5 billion, an annual operating cost of \$26.7 million, and a net annualized cost of \$305.5 million. The monorail option is substantially higher in cost than the light rail due to higher engineering design costs and the cost of constructing an elevated structure for a distance of 36.8 km (23 mi). The cost effectiveness is estimated at \$74.28, and a subsidy of \$4.12 per passenger.

**Table 2.2-2**  
**Summary of Capital and Operating Costs**

Alternative	Annual Operating Cost (millions)	Capital Cost <sup>1</sup> (millions)	Net Annualized Cost <sup>2</sup>		Per-Passenger Subsidy <sup>4</sup>
			(millions)	Cost Effectiveness <sup>3</sup>	
B (light rail)	\$16.8	\$599	\$57.2	\$13.04	\$1.81
B (monorail)	\$26.7	\$ 3.5 billion	\$305.5	\$74.28	\$4.12
C (light rail)	\$15.9	\$675-\$701	\$63.4	\$13.34	\$1.40
C (monorail)	\$25.8	\$3.7 billion	\$318.2	\$70.11	\$3.46
D	\$4.4	\$108	\$7.2	\$4.41	0
E	\$0.25	\$93	\$7.6	N/A	NA
F	\$0.42	\$119	\$9.7	N/A	NA

1 Range of costs represents difference between costs of the north and south transit bridges options (Alternative C)

2 Annual cost minus revenues

3 Annual cost per new rider

4 Difference between annual operating costs and revenues, on a per-passenger basis

### 2.2.2.3 Operations

A preliminary operations plan for the heavy rail system was developed based on review of previously documented efforts, review of the preliminary ridership projections, and data on the existing Shore Line East commuter rail service operated along the Northeast Corridor. Based on this information, a conceptual service plan was developed for this rail service alternative.

The development of a preliminary operations plan for the transitway involved review of the proposed station locations, preliminary ridership projections, and proposed infrastructure as well as input from the community. Based on this information, a conceptual service plan was developed for the transitway. Based on the operations plan, the following items were analyzed: travel time, ridership projections, conceptual service plan, and equipment requirements.

#### Travel Times

The operations planning process first developed projected operating times along the proposed route. From prior planning efforts, maximum operating speeds along the existing track were reviewed to determine operating times. The NECR is an active freight route and is maintained to FRA Class 3 standards. As of August 1998, the NECR was operating one freight train daily along the line. This train departs Palmer, Massachusetts at 5:00 AM and returned from New London in the afternoon. If there is sufficient traffic, a second daily train departs Palmer at 8:00 AM and returns in the late afternoon. This preliminary analysis assumes

that these existing freight train movements can be accommodated within the passenger rail service schedule and that operating windows free of interference from freight traffic will be negotiated. It was also assumed that the rail line would be maintained to FRA Class 3 standards, which allow a maximum operating speed for passenger trains of 96 kph (60 MPH). However, geometric constraints limit speeds to a maximum of 80 kph (50 MPH), with many sections restricted to 60 kph (40 MPH). Based on this analysis, a one way travel time (with station stops) of 28 to 30 minutes was developed. A 10 to 15-minute turnaround time is assumed at each terminus to prepare the train for a return trip.

Projected operating times along the transitway were also developed. The transitway infrastructure includes two tracks between the Norwich State Hospital Transportation Center and the Northeast Corridor in Westerly. A single track system is provided along the P&W right-of-way between the State Hospital and the Norwich East Transportation Centers and along the Northeast Corridor right-of-way to the Westerly Station. Maximum operating speeds were determined based on vehicle type and the proposed alignment's curvature and physical constraints. Generally, a maximum operating speed of 80 kilometers/hour (50 miles per hour) is assumed. With these operating speeds, a one-way travel time, including stops at the 7 proposed stations, is 36 to 38 minutes. A 5 to 10-minute turnaround time is assumed at each terminus to prepare the train for a return trip.

To connect transitway passengers with the commuter rail system on the New England Central, a shuttle bus service is proposed between the Norwich State Hospital Transportation Center and the Mohegan Sun Resort station. The one-way travel time for this shuttle service is estimated to be 5 to 8 minutes.

### **Ridership Projections**

Preliminary boarding projections were prepared for the commuter rail service alternative. These projections, prepared and documented as part of the overall travel demand modeling process, yielded the following results for the proposed commuter rail service area as summarized in Table 2.2-3. Total annual ridership is estimated at 4.9 million.

**Table 2.2-3**  
**Transit Boardings by Station (Commuter Rail)\***

Station	Alternative B	Alternative C
New London	318	349
Coast Guard Academy/CCC	200	215
Waterford	85	98
Mohegan Sun Resort	851	981
Norwich West Transportation Center	352	348
I-395 Transportation Center	552	493
<b>Total Boardings</b>	<b>2,366</b>	<b>2,484</b>

: \* Boardings are assumed to be the same for both light rail and monorail options

Preliminary ridership projections were prepared for the transitway alternative. These projections, prepared and documented as part of the overall travel demand modeling process, yielded the following results for the proposed transitway service area as summarized in Table 2.2-4.

**Table 2.2-4**  
**Transit Boardings by Station (Transitway)**

Stations	Alternative B	Alternative C
Westerly, RI	398	425
I-95 (Exit 92) Transportation Center	3,412	3,555
North Stonington	105	110
Foxwoods Casino	4,762	4,809
Poquetanuck Village	78	79
Norwich State Hospital Transportation Center*	2,417	2,799
Norwich East Transportation Center	403	482
<b>Total Boardings</b>	<b>11,576</b>	<b>12,259</b>

\* Includes transfers to/from the NEC rail system.

### Conceptual Service Plan

A conceptual service plan was developed from the travel time estimates, and preliminary ridership projections, Light rail or monorail service is proposed to operate along the transitway seven days a week, 24-hours a day. The plan

consists of 72 roundtrips each day operating on 20-minute headways throughout the day. Passenger rail service is proposed to operate along the NEC line seven days a week from 6:00 AM until 11:00 PM. The plan consists of 35 roundtrips each day operating on 30-minute headways throughout the 17 hour service day.

### **Equipment Requirements**

Given the service plan identified, 4 sets of equipment are required. Therefore, with spare equipment requirements, 5 train sets are required.

It has been assumed that a modern, low floor light rail vehicle will be used for the transitway. For the monorail system, vehicles similar to the Jacksonville, Florida system were selected. A 42-passenger bus will be sufficient for the shuttle service between the transitway and NECR passenger service.

Light rail cars are smaller than standard heavy rail or commuter rail cars, and draw power from an overhead electrical system. An articulated light rail vehicle was chosen to provide the desired service. The vehicle has a cab-control compartment on both ends, and is 28 m (92 feet) in length. The vehicle's total passenger capacity is 166, with 72 seated passengers and 94 standees. The operations plan assumes that all passengers would be seated under typical conditions. Based on this capacity and the projected ridership, a one-car train will likely be sufficient. Given the service plan identified, 5 trains will operate at one time. Therefore, with spare equipment requirements, a total of 7 vehicles are needed.

An electric monorail system would operate on an elevated track or beam. A 2-car monorail vehicle was chosen, which will accommodate 90 passengers, with seating capacity dependent on intended usage. In order to provide the desired service, 5 monorail trains will operate at one time. Therefore, with 2 spares, a total of 7 monorail trains (14 cars) are needed.

With the shuttle service, 2 buses are adequate to meet the schedule. With spares, a total of 3 buses are needed.

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#### **2.2.3 Alternative C (Rail/Transit with Bridge Connection)**

Alternative C would incorporate all elements of Alternative B, but would include the construction of a fixed-span bridge across the Thames River to provide direct connections between the Transitway and the Commuter Rail line ([Figure 2.2-2](#)). Two options are included in this Draft EIS, a southern or northern light rail (or monorail) bridge.

### **2.2.3.1 Description**

The southern bridge option would construct a transit bridge parallel to and immediately north of the existing Route 2A (Mohegan-Pequot) Bridge. This bridge would be approximately 430 meters (1,410 feet) long. The new structure would require the placement of new piers and footings in the river, but would maintain horizontal and vertical navigational clearances. Due to the elevation difference between the bridge and the NECR line, a transfer station and elevator would be required to allow passengers to transfer between the two systems (Figure 2.2-19).

The northern bridge option would construct a transit bridge extending diagonally across the river in a northwest/southeast direction, with the southeastern terminus approximately 150 meters (500 feet) north of the existing Route 2A (Mohegan-Pequot) Bridge. The new structure would be approximately 725 meters (2,375 feet) long, and would be elevated over the P & W and the NECR tracks. The structure would require the placement of new piers and footings in the river, but would maintain adequate horizontal and vertical (15 meters, 48 feet) navigational clearances of the channel (Figure 2.2-20).

### **2.2.3.2 Estimated Costs**

Costs for Alternative C have been estimated separately for the light rail and monorail modes. The Northern Bridge, for light rail, would have an estimated construction cost of \$103.4 million, and \$142.6 million for monorail. The Southern Bridge, for light rail, would have an estimated construction cost of \$77.1 million, or \$103 million for monorail. As shown on Table 2.2-2, the light rail mode would have an estimated capital cost of \$675-701 million, with an annual operating cost of \$15.9 million. The net annualized cost would be approximately \$63.4 million, with a cost effectiveness (cost per new transit rider) of \$13.4 and a per-passenger subsidy of \$1.40. The capital costs do not include costs of acquiring new right-of-way.

The monorail mode would be substantially more expensive, with a capital cost of \$3.7 billion, an annual operating cost of \$25.8 million, and a net annualized cost of \$318.2 million. Monorail costs include construction of an elevated structure for a distance of 36.8 km (23 mi). The cost effectiveness is estimated at \$70.11, with a per-passenger subsidy of \$3.46. The capital costs do not include costs of acquiring new right-of-way.

### **2.2.3.3 Operations**

All aspects of the preliminary operations plan for the Transitway are similar to Alternative B except that the shuttle bus service between the transitway and commuter rail services is replaced by a light rail connection. This connection creates a new branch of the transitway at the Norwich State Hospital

Transportation Center. The connection across the Thames River is accomplished with one of 2 bridge options. The basis for this operations plan is the Alternative B transitway plan with the operational changes added for the service connection.

### **Travel Times**

Maximum operating speeds were determined based on vehicle type and the proposed alignment's curvature and physical constraints. Train trips that are not using the rail bridge connection and continue to the Norwich East Transportation Center will have the same travel time as calculated for Alternative B service (36 to 38 minutes one-way with a 5 to 10 minute turnaround time is assumed at each terminus to prepare the train for a return trip). For train trips using the south bridge and connecting at a transfer station on the west bank of the river, one-way travel time would be 32 to 43 minutes. Using the north bridge that ties directly into the Mohegan Sun Resort Station results in a one-way travel time of 33 to 35 minutes.

### **Ridership Projections**

Preliminary ridership projections were prepared for this alternative. These projections, prepared and documented as part of the overall travel demand modeling process, yielded the following results for the proposed transitway service area as summarized in Table 2.2-4. Total estimated annual ridership is estimated at 5.3 million.

### **Conceptual Service Plan**

The same basic service plan as developed for Alternative B will be used. Trains will operate 7 days a week, 24-hours a day, with 20-minute headways. The one change will be in operations at the north or west end of the line. Every other train will utilize the new rail bridge connection to the New England Central service. This action will maintain the 20-minute headway service on the trunk line between Norwich State Hospital Transportation Center and Westerly. From the state hospital site station north to the Norwich East Transportation Center and west to the Mohegan Sun station, service will operate on 40-minute headways.

### **Equipment Requirements**

For this alternative, the same light rail or monorail equipment requirements as discussed in Alternative B are needed, without the 3 shuttle buses.

## **2.2.4 Alternative D (Busway)**

Alternative D would include construction of a dedicated busway, on the same alignment described for the transitway in Alternatives B and C, extending between the Westerly Amtrak station and Route 214. From Route 214 to the Foxwoods Station, and north to the Norwich East Transportation Center, bus service would use the existing Route 2 (Figure 2.2-21). Upgrades to Route 2 between the Shetucket River in Norwich and the Preston town line would be required to accommodate bus traffic, and between Route 214 and I-95 in North Stonington for safety (Figure 2.2-17).

### **2.2.4.1 Description**

Alternative D includes four elements: the dedicated busway, 6 transit stations, upgrades to Route 2 in Norwich, and upgrades to Route 2 in North Stonington (Table 2.2-1)

#### **Busway**

The Busway would be designed to provide bus service, and would be compatible with future conversion to light rail. The right-of-way width anticipated for the busway would be 19.3 m (64 ft), sufficient to provide two lanes for optimal service (Figure 2.2-22). Intersections with major roadways would be grade-separated. All at-grade intersections will be protected with gates and signals. The busway route is 20.1 km (12.6 mi) in length, and extends from the Norwich East Transportation Center at the intersection of Routes 2 and 12 to the Westerly Amtrak Station, with a new dedicated right-of-way between Route 2 at Wintechog Hill Road and the Westerly Station. The busway was not extended to Norwich via the Norwich State Hospital site because it is not feasible to add the busway within the existing P&W right-of-way. This analysis assumes that charter buses destined to the Foxwoods casino would be allowed to use the busway, and would access it at the Exit 92 station. This analysis also assumes that the current Foxwoods employee buses would be replaced by this service.

Buses would use existing Route 2 from the Norwich Transportation Center to the Foxwoods Station on north side of Route 2, and cross to the south of Route 2 east of at the intersection with Route 214. A dedicated busway from this point south would generally follow the former trolley line to the intersection of Routes 2 and 201, where it would cross back to the north side of Route 2.

The busway alignment would continue north of North Stonington village, crossing Wyassup Road approximately 400 m (1,300 ft) north of Babcock Road. The alignment would be located east of Route 2, crossing Route 184 approximately 300 m (1,000 ft) east of the rotary. From Route 184, the Busway would cross over I-95, intersect Route 49, and include a transportation center on the east side of Route 49.

South of the transportation center, the busway would continue south along the west side of the Pawcatuck River, and would be bridged across the Pawcatuck River north of Route 78. The alignment would cross White Rock Road in Westerly approximately 50 m (160 ft) north of Route 78. The bus transitway would follow Route 78 to the Amtrak right-of-way, and would be constructed parallel to the Amtrak tracks for 1.8 km (1.2 mi) to the Westerly station.

### **Busway Stations**

Alternative D would provide bus service to the Westerly, I-95, Foxwoods, North Stonington, and Norwich East Transportation Centers described under Alternative B. No new construction would be required at the Westerly or Norwich East Transportation Centers to accommodate bus service. In addition, the bus service would include a stop at the current Foxwoods employee parking lot (Fox Hill) on Route 2 in Norwich.

### **Route 2 Upgrades**

Two segments of Route 2 would be upgraded to a uniform 2-lane cross-section. These upgrades would improve roadway safety.

Route 2 in Norwich, from the Preston town line to the Shetucket River, would be upgraded for a distance of approximately 2 km (1.3 mi) to a uniform urban cross-section in the northern segment (1.2-m or 4-ft shoulders). The upgrade would include improvements to the Route 2 – Palmer Street intersection. [Figure 2.2-22](#) illustrates the planning concept.

Route 2 in North Stonington, from Route 214 to I-95, would be upgraded to provide a uniform roadway cross-section of 12.2 m (40 ft), with two 3.7-m (12-ft) travel lanes and two 2.4-m (8-ft) paved shoulders. The upgrade would extend approximately 11.4 km (7.3 mi).

#### **2.2.4.2 Estimated Costs**

Alternative D would have an estimated capital cost of \$107.9 million, which includes a construction cost of \$104.2 million and a \$3.7 million capital equipment cost. The annual operating cost is estimated at \$4.4 million (Table 2.2-2). The net annualized cost would be approximately \$7.2 million, with a cost effectiveness (cost per new transit rider) of \$4.41, and would not require a per-passenger subsidy. The acquisition of new right-of-way is estimated at \$600,000.

### **2.2.4.3 Operations**

The development of a preliminary operations plan for the Route 2 Bus Transitway involved review of the infrastructure, the station locations, the on-street operations portion of the service, and input from the community. The SEAT plan (*Southeast Area Transit: A System in Transition*) was also reviewed. Based on this information, a conceptual service plan was developed for the transitway.

#### **Travel Times**

The operations planning process first developed projected operating times along the proposed route. Maximum operating speeds were determined based on safety, the proposed alignment's curvature, and projected on-street traffic conditions. Generally, a maximum 80 kilometers per hour (50 miles per hour) operating speed is assumed. A one-way travel time, including 6 proposed service stops, is estimated to be 30 minutes. A 5-minute turnaround time is assumed at each terminus to prepare the bus for a return trip.

#### **Ridership Projections**

Preliminary ridership projections were prepared for the busway alternative. These projections, prepared and documented as part of the overall travel demand modeling process, yielded the following results for the proposed transitway service area as summarized in Table 2.2-5. Total estimated annual ridership is 3.8 million.

**Table 2.2-5**  
**Transit Boardings by Station (Busway)**

Station	Daily Trips
Westerly, RI	264
I-95 (Exit 92) Transportation Center	2,751
North Stonington	36
Foxwoods Casino	5,080
Fox Hill	2,237
Norwich East Transportation Center	75
Total Daily Trips	10,443

### Conceptual Service Plan

From the travel time estimates and preliminary ridership projections, a conceptual service plan was developed. Bus service is proposed to operate seven days a week, 24 hours a day. The plan consists of 72 roundtrips each day operating on 20-minute headways throughout the day.

### Equipment Requirements

A 12-meter (40-foot) diesel or liquid natural gas (LNG) fuel bus was selected to provide the desired service. Average seating capacity is 42 with a maximum load of 70. Based on the schedule, 8 buses will operate at one time. Four spare buses are included in the equipment requirements to compensate for the additional wear-and-tear anticipated to result from operations on city streets. Therefore, a total of 12 vehicles is needed.

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#### 2.2.5 Alternative E (Route 2A Bypass)

Alternative E includes a bypass of Route 2A from Route 12 to Route 2 in Preston ([Figure 2.2-24](#)). This alternative also includes widening the existing Route 2A bridge, and Route 2A from the bridge to Route 12, to 4 lanes, widening Route 2 to 4 lanes from the Route 2A Bypass to Route 164 in Preston, and widening Route 2 to 4 lanes from Route 214 to I-95 in North Stonington. Other transportation improvements included in Alternative E include upgrading Route 32 and Route 164 (Table 2.2-1).

### 2.2.5.1 Description

This section includes descriptions of each of the elements of Alternative E.

#### Route 2A Bridge Widening

The Route 2A (Mohegan-Pequot) Bridge would be widened from its existing 2 lanes to 4 lanes by the construction of a new 2-lane bridge parallel to and immediately south of the existing bridge. The new structure would require the placement of new piers and footings in the river, but would maintain the horizontal and vertical navigational clearances of the existing bridge (Figure 2.2-25). Route 2A would also be widened to provide 4 travel lanes between the bridge and the Route 12 intersection.

#### Route 2A Bypass

The Route 2A Bypass would be a new roadway constructed with a uniform 4-lane cross section. The proposed cross-section would provide a 27.5-m (88-ft) roadway with 3-m (10-ft) shoulders, four 3.7-m (12-ft) travel lanes, 0.6-m (2-ft) inside shoulders, and a 5-m (16-ft) grassed median (Figure 2.2-17). There would be no intersections with local roads: the only access to the bypass would be at the terminal points. The new roadway would be approximately 3.5 km (2.3 mi) in length, extending from Route 12 at the Mohegan-Pequot Bridge to Route 2, approximately 200 m (650 ft) north of Schoolhouse Road. It would cross over Route 2A, Harris Fuller Road, and Middle Road. Figure 2.2-26 illustrates the planning concept for this element.

#### Route 2 Widening

Two segments of Route 2 would be widened to a uniform 4-lane cross-section. The proposed cross-section would provide a 27.5-m (88-foot) roadway with 2.4-m (8-ft) shoulders, four 3.7-m (12-ft) travel lanes, 0.6-m (2-ft) inside shoulders, and a 5-m (16-ft) grassed median. Turning lanes would be provided at intersections as warranted by traffic volume.

Route 2 in Preston, from the terminus of the Route 2A Bypass to Route 164, would be widened to a uniform 4-lane cross-section. This widening would include approximately 4.5 km (2.8 mi) of roadway. Figure 2.2-27 illustrates the planning concept for this widening.

Route 2 in North Stonington, from Route 214 to I-95, would be widened to a uniform 4-lane cross-section. This widening would include approximately 11.4 km (7.3 mi) of roadway. The Route 2 – Route 184 Rotary would be redesigned as a signalized intersection. Figure 2.2-28 illustrates the planning concept for the widening of this segment of Route 2.

### **Route 32 Upgrade**

The upgrade of Route 32 in Montville and Waterford would extend from Route 2A south to the I-395 Connector, a distance of approximately 7.8 km (5.1 mi). The proposed improvements would provide a uniform roadway cross-section of 12.2 m (40 ft), with two 3.7-m (12-ft) travel lanes and two 2.4-m (8-ft) paved shoulders. In densely developed areas where there are sidewalks, the cross-section would be as shown for Route 2 in Norwich with 1.2-m (4-ft) shoulders and would preserve any existing sidewalks. Climbing lanes would be provided on steep grades. Minor improvements to intersections, particularly at Lathrop Road in Waterford, would be included in the upgrade. [Figure 2.2-29](#) illustrates the planning concept for the Route 32 upgrade.

### **Route 164 Upgrade**

The upgrade of Route 164 in Preston extends from Route 165 south to Route 2, a distance of approximately 4.5 km (2.9 mi). The proposed improvements would provide a uniform roadway cross-section of 12.2 m (40 ft), with two 3.7-m (12-ft) travel lanes and two 2.4-m (8-ft) paved shoulders. Minor improvements to intersections would be included in the upgrade. [Figure 2.2-30](#) illustrates the planning concept for this element.

#### **2.2.5.2 Estimated Costs**

Costs for Alternative E have been estimated based on standard engineering methodology. This alternative would have an estimated capital cost of \$93.3 million, with an annual operating cost of \$2.5 million. The net annualized cost would be approximately \$7.6 million. The acquisition of new right-of-way is estimated to cost \$1.7 million.

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#### **4.2.1 Alternative F (Route 2A and Route 2 Bypasses)**

Alternative F includes a bypass of Route 2A from Route 12 to Route 2 in Preston, and construction of a bypass of Route 2 from Route 214 to I-95 in North Stonington ([Figure 2.2-31](#)). This alternative also includes widening the existing Route 2A bridge and Route 2A from the bridge to Route 12 to 4 lanes and widening Route 2 to 4 lanes from the Route 2A Bypass to Route 164 in Preston. Other transportation improvements included in Alternative F include upgrading Route 32 and Route 164 (Table 2.2-1).

### **2.2.6.1 Description**

Alternative F would include all of the elements of Alternative E described above (Route 2A Bridge, Route 2A Bypass, Route 32 Upgrade, Route 164 Upgrade, and Route 2 Widening in Preston), with the exception of the Route 2 Widening from Route 214 to I-95 in North Stonington. Alternative F instead includes the Route 2 Bypass element described below.

#### **Route 2 Bypass**

This new roadway would be constructed with a uniform 4-lane cross section, as described for the Route 2A Bypass ([Figure 2.2-17](#)). All local roads would be crossed via bridges or underpasses, and no new intersections would be created. The only access to the bypass would be at the terminal intersections with Route 2.

The new roadway would be approximately 10.7 km (6.8 mi) in length, extending from Route 2 just east of Route 214 to the frontage road at Exit 92 of I-95. The bypass would cross Wintechog Road, Route 201 (approximately 400 m (1,300 ft)) south of the Jeremy Hill Road intersection), Jeremy Hill Road, and Route 184 (400 m (1,300 ft) east of Jeremy Hill Road). The bypass would also cross Stony Brook Road, North Anguilla Road at the gas pipeline, and would have a signalized at-grade intersection with Route 2 approximately 400 m (1,300 ft) north of I-95. [Figure 2.2-32](#) illustrates the planning concept for the Route 2 bypass.

### **2.2.6.2 Estimated Costs**

Costs for Alternative F have been estimated based on standard engineering methodology. This alternative would have an estimated capital cost of \$131 million, with an annual operating cost of \$4.2 million. The net annualized cost would be approximately \$9.7 million. The estimated cost of acquiring new right-of-way is \$1.7 million.

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